#4

SEQUENCE LISTING

<110> De Robertis, Edward M.
Bouwmeester, Tewis

<120> Endoderm, Cardiac and Neural Inducing Factors

<130> 510015-257

<140> US 09/903,325
<141> 2001-07-11

<150> US 60/020,150
<151> 1996-06-20

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<170> FastSEQ for Windows Version 3.0

<210> 1
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<212> PRT
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<400> 1

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Ser Leu Asn Ser Arg Gly Tyr Phe Arg Lys Glu Arg Gly Ala Arg Arg
        35                  40                  45
Ser Lys Ile Leu Leu Val Asn Thr Lys Gly Leu Asp Glu Pro His Ile
    50                  55                  60
Gly His Gly Asp Phe Gly Leu Val Ala Glu Leu Phe Asp Ser Thr Arg
65                  70                  75                  80
Thr His Thr Asn Arg Lys Glu Pro Asp Met Asn Lys Val Lys Leu Phe
                85                  90                  95
Ser Thr Val Ala His Gly Asn Lys Ser Ala Arg Arg Lys Ala Tyr Asn
            100                 105                 110
Gly Ser Arg Arg Asn Ile Phe Ser Arg Arg Ser Phe Asp Lys Arg Asn
        115                 120                 125
Thr Glu Val Thr Glu Lys Pro Gly Ala Lys Met Phe Trp Asn Asn Phe
    130                 135                 140
Leu Val Lys Met Asn Gly Ala Pro Gln Asn Thr Ser His Gly Ser Lys
145                 150                 155                 160
Ala Gln Glu Ile Met Lys Glu Ala Cys Lys Thr Leu Pro Phe Thr Gln
                165                 170                 175
Asn Ile Val His Glu Asn Cys Asp Arg Met Val Ile Gln Asn Asn Leu
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            180                 185                 190
Cys Phe Gly Lys Cys Ile Ser Leu His Val Pro Asn Gln Gln Asp Arg
        195                 200                 205
Arg Asn Thr Cys Ser His Cys Leu Pro Ser Lys Phe Thr Leu Asn His
    210                 215                 220
Leu Thr Leu Asn Cys Thr Gly Ser Lys Asn Val Val Lys Val Val Met
225                 230                 235                 240
Met Val Glu Glu Cys Thr Cys Glu Ala His Lys Ser Asn Phe His Gln
                245                 250                 255
Thr Ala Gln Phe Asn Met Asp Thr Ser Thr Thr Leu His His
            260                 265                 270
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<210> 2
<211> 1338
<212> DNA
<213> Xenopus

<400> 2

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aaggacgaga aaggacaaaa acatattcac ttaacagcag aggttacttc agaaaagaaa     180
gaggagcacg taggagcaag attctgctgg tgaatactaa aggtcttgat gaaccccaca     240
ttgggcatgg tgattttcgc ttagtagctg aactatttga ttccaccaga acacatacaa     300
acagaaaaga gccagacatg aacaaagtca agcttttctc aacagttgcc catggaaaca     360
aaagtgcaag aagaaaagct tacaatggtt ctagaaggaa tatttttcct cgccgttctt     420
ttgataaaag aaatacagag gttactgaaa agcctggtgc caagatgttc tggaacaatt     480
ttttggttaa aatgaatgga gccccacaga atacaagcca tggcagtaaa gcacaggaaa     540
taatgaaaga agcttgcaaa accttgtttt tcactcagaa tattgtacat gaaaactgtg     600
acaggatggt gatacagaac aatctgtgct ttggtaaatg catctctctc catgttccaa     660
atcagcaaga tcgacgaaat acttgttccc attgcttgcc gtccaaattt accctgaacc     720
acctgacgct gaattgtact ggatctaaga atgtagtaaa ggttgtcatg atggtagagg     780
aatgcacgtg tgaagctcat aagagcaact tccaccaaac tgcacagttt aacatggata     840
catctactac cctgcaccat taaaggactg ccatacagta tggaaatgcc cttttgttgg     900
aatatttgtt acatactatg catctaaagc attatgttgc cttctatttc atataaccac     960
atggaataag gattgtatga attataatta acaaatggca ttttgtgtaa catgcaagat    1020
ctctgttcca tcagttgcaa gataaaaggc aatatttgtt tgacttttct tctacaaaat    1080
gaatacccaa atatatgata agataatggg gtcaaaactg ttaaggggta atgtaataat    1140
agggactaag tttgcccagg agcagtgacc cataacaacc aatcagcagg tatgatttac    1200
tggtcacctg tttaaaagca aacatcttat tggttgctat gggttactgc ttctgggcaa    1260
aatgtgtgcc tcataggggg gttagtgtgt tgtgtactga ataaattgta tttatttcat    1320
tgttacaaaa aaaaaaaa                                                  1338
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<210> 3
<211> 318
<212> PRT
<213> Xenopus frazzled

<400> 3

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Gly Leu Ala Leu Leu Leu Leu Pro Asn Ala Tyr Cys Ala Ser Cys Glu
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            20                  25                  30
Pro Val Arg Ile Pro Met Cys Lys Ser Met Pro Trp Asn Met Thr Lys
        35                  40                  45
Met Pro Asn His Leu His His Ser Thr Gln Ala Asn Ala Ile Leu Ala
    50                  55                  60
Ile Glu Gln Phe Glu Gly Leu Leu Thr Thr Glu Cys Ser Gln Asp Leu
65                  70                  75                  80
Leu Phe Phe Leu Cys Ala Met Tyr Ala Pro Ile Cys Thr Ile Asp Phe
                85                  90                  95
Gln His Glu Pro Ile Lys Pro Cys Lys Ser Val Cys Glu Arg Ala Arg
            100                 105                 110
Ala Gly Cys Glu Pro Ile Leu Ile Lys Tyr Arg His Thr Trp Pro Glu
        115                 120                 125
Ser Leu Ala Cys Glu Glu Leu Pro Val Tyr Asp Arg Gly Val Cys Ile
    130                 135                 140
Ser Pro Glu Ala Ile Val Thr Val Glu Gln Gly Thr Asp Ser Met Pro
145                 150                 155                 160
Asp Phe Ser Met Asp Ser Asn Asn Gly Asn Cys Gly Ser Gly Arg Glu
                165                 170                 175
His Cys Lys Cys Lys Pro Met Lys Ala Thr Gln Lys Thr Tyr Leu Lys
            180                 185                 190
Asn Asn Tyr Asn Tyr Val Ile Arg Ala Lys Val Lys Glu Val Lys Val
        195                 200                 205
Lys Cys His Asp Ala Thr Ala Ile Val Glu Val Lys Glu Ile Leu Lys
    210                 215                 220
Ser Ser Leu Val Asn Ile Pro Lys Asp Thr Val Thr Leu Tyr Thr Asn
225                 230                 235                 240
Ser Gly Cys Leu Cys Pro Gln Leu Val Ala Asn Glu Glu Tyr Ile Ile
                245                 250                 255
Met Gly Tyr Glu Asp Lys Glu Arg Thr Arg Leu Leu Leu Val Glu Gly
            260                 265                 270
Ser Leu Ala Glu Lys Trp Arg Asp Arg Leu Ala Lys Lys Val Lys Arg
        275                 280                 285
Trp Asp Gln Lys Leu Arg Arg Pro Arg Lys Ser Lys Asp Pro Val Ala
    290                 295                 300
Pro Ile Pro Asn Lys Asn Ser Asn Ser Arg Gln Ala Arg Ser
305                 310                 315
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<210> 4
<211> 1875
<212> DNA
<213> Xenopus frazzled

<400> 4

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ctaattctgc acttttaaat tatctgagta attgttcatt ttgtattgga tgggactaaa     180
gataaactta actccttgct tttgacttgc ccataaacta taaggtgggg tgagttgtag     240
ttgcttttac atgtgcccag attttccctg tattccctgt attccctcta aagtaagcct     300
acacatacag gttgggcaga ataacaatgt ctcgaacaag gaaagtggac tcattactgc     360
tactggccat acctggactg gcgcttctct tattacccaa tgcttactgt gcttcgtgtg     420
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agcctgtgcg gatccccatg tgcaaatcta tgccatggaa catgaccaag atgcccaacc     480
atctccacca cagcactcaa gccaatgcca tcctggcaat tgaacagttt gaaggtttgc     540
tgaccactga atgtagccag gacctttttgt tctttctgtg tgccatgtat gcccccattt     600
gtaccatcga tttccagcat gaaccaatta agccttgcaa gtccgtgtgc gaaagggcca     660
gggccggctg tgagcccatt ctcataaagt accggcacac ttggccagag agcctggcat     720
gtgaagagct gcccgtatat gacagaggag tctgcatctc cccagaggct atcgtcacag     780
tggaacaagg aacagattca atgccagact tctccatgga ttcaaacaat ggaaattgcg     840
gaagcggcag ggagcactgt aaatgcaagc ccatgaaggc aacccaaaag acgtatctca     900
agaataatta caattatgta atcagagcaa aagtgaaaga ggtgaaagtg aaatgccacg     960
acgcaacagc aattgtggaa gtaaaggaga ttctcaagtc ttccctagtg aacattccta    1020
aagacacagt gacactgtac accaactcag gctgcttgtg cccccagctt gttgccaatg    1080
aggaatacat aattatgggc tatgaagaca aagagcgtac caggcttcta ctagtggaag    1140
gatccttggc cgaaaaatgg agagatcgtc ttgctaagaa agtcaagcgc tgggatcaaa    1200
agcttcgacg tcccaggaaa agcaaagacc ccgtggctcc aattcccaac aaaaacagca    1260
attccagaca agcgcgtagt tagactaacg gaaaggtgta tggaaactct atggactttg    1320
aaactaagat ttgcattgtt ggaagagcaa aaaagaaatt gcactacagc acgttatatt    1380
ctattgttta ctacaagaag ctggtttagt tgattgtagt tctcctttcc ttctttttttt    1440
ttataactat atttgcacgt gttcccaggc aattgtttta ttcaacttcc agtgacagag    1500
cagtgactga atgtctcagc ctaaagaagc tcaattcatt tctgatcaac taatggtgac    1560
aagtgtttga tacttgggga aagtgaacta attgcaatgg taaatcagag aaaagttgac    1620
caatgttgct tttcctgtag atgaacaagt gagagatcac atttaaatga tgatcacttt    1680
ccatttaata ctttcagcag ttttagttag atgacatgta ggatgcacct aaatctaaat    1740
attttatcat aaatgaagag ctggtttaga ctgtatggtc actgttggga aggtaaatgc    1800
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aaaaaaaaaa aaaaa                                                     1875
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<210> 5
<211> 896
<212> PRT
<213> Xenopus

<400> 5

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Met Leu Leu Leu Phe Arg Ala Ile Pro Met Leu Leu Leu Gly Leu Met
 1               5                  10                  15
Val Leu Gln Thr Asp Cys Glu Ile Ala Gln Tyr Tyr Ile Asp Glu Glu
            20                  25                  30
Glu Pro Pro Gly Thr Val Ile Ala Val Leu Ser Gln His Ser Ile Phe
        35                  40                  45
Asn Thr Thr Asp Ile Pro Ala Thr Asn Phe Arg Leu Met Lys Gln Phe
    50                  55                  60
Asn Asn Ser Leu Ile Gly Val Arg Glu Ser Asp Gly Gln Leu Ser Ile
65                  70                  75                  80
Met Glu Arg Ile Asp Arg Glu Gln Ile Cys Arg Gln Ser Leu His Cys
                85                  90                  95
Asn Leu Ala Leu Asp Val Val Ser Phe Ser Lys Gly His Phe Lys Leu
            100                 105                 110
Leu Asn Val Lys Val Glu Val Arg Asp Ile Asn Asp His Ser Pro His
        115                 120                 125
Phe Pro Ser Glu Ile Met His Val Glu Val Ser Glu Ser Ser Ser Val
    130                 135                 140
Gly Thr Arg Ile Pro Leu Glu Ile Ala Ile Asp Glu Asp Val Gly Ser
```

```
145                 150                 155                 160
Asn Ser Ile Gln Asn Phe Gln Ile Ser Asn Asn Ser His Phe Ser Ile
                165                 170                 175
Asp Val Leu Thr Arg Ala Asp Gly Val Lys Tyr Ala Asp Leu Val Leu
            180                 185                 190
Met Arg Glu Leu Asp Arg Glu Ile Gln Pro Thr Tyr Ile Met Glu Leu
        195                 200                 205
Leu Ala Met Asp Gly Gly Val Pro Ser Leu Ser Gly Thr Ala Val Val
    210                 215                 220
Asn Ile Arg Val Leu Asp Phe Asn Asp Asn Ser Pro Val Phe Glu Arg
225                 230                 235                 240
Ser Thr Ile Ala Val Asp Leu Val Glu Asp Ala Pro Leu Gly Tyr Leu
                245                 250                 255
Leu Leu Glu Leu His Ala Thr Asp Asp Asp Glu Gly Val Asn Gly Glu
            260                 265                 270
Ile Val Tyr Gly Phe Ser Thr Leu Ala Ser Gln Glu Val Arg Gln Leu
        275                 280                 285
Phe Lys Ile Asn Ser Arg Thr Gly Ser Val Thr Leu Glu Gly Gln Val
    290                 295                 300
Asp Phe Glu Thr Lys Gln Thr Tyr Glu Phe Glu Val Gln Ala Gln Asp
305                 310                 315                 320
Leu Gly Pro Asn Pro Leu Thr Ala Thr Cys Lys Val Thr Val His Ile
                325                 330                 335
Leu Asp Val Asn Asp Asn Thr Pro Ala Ile Thr Ile Thr Pro Leu Thr
            340                 345                 350
Thr Val Asn Ala Gly Val Ala Tyr Ile Pro Glu Thr Ala Thr Lys Glu
        355                 360                 365
Asn Phe Ile Ala Leu Ile Ser Thr Thr Asp Arg Ala Ser Gly Ser Asn
    370                 375                 380
Gly Gln Val Arg Cys Thr Leu Tyr Gly His Glu His Phe Lys Leu Gln
385                 390                 395                 400
Gln Ala Tyr Glu Asp Ser Tyr Met Ile Val Thr Thr Ser Thr Leu Asp
                405                 410                 415
Arg Glu Asn Ile Ala Ala Tyr Ser Leu Thr Val Val Ala Glu Asp Leu
            420                 425                 430
Gly Phe Pro Ser Leu Lys Thr Lys Lys Tyr Tyr Thr Val Lys Val Ser
        435                 440                 445
Asp Glu Asn Asp Asn Ala Pro Val Phe Ser Lys Pro Gln Tyr Glu Ala
    450                 455                 460
Ser Ile Leu Glu Asn Asn Ala Pro Gly Ser Tyr Ile Thr Thr Val Ile
465                 470                 475                 480
Ala Arg Asp Ser Asp Ser Asp Gln Asn Gly Lys Val Asn Tyr Arg Leu
                485                 490                 495
Val Asp Ala Lys Val Met Gly Gln Ser Leu Thr Thr Phe Val Ser Leu
            500                 505                 510
Asp Ala Asp Ser Gly Val Leu Arg Ala Val Arg Ser Leu Asp Tyr Glu
        515                 520                 525
Lys Leu Lys Gln Leu Asp Phe Glu Ile Glu Ala Ala Asp Asn Gly Ile
    530                 535                 540
Pro Gln Leu Ser Thr Arg Val Gln Leu Asn Leu Arg Ile Val Asp Gln
545                 550                 555                 560
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B1

```
Asn Asp Asn Cys Pro Val Ile Thr Asn Pro Leu Leu Asn Asn Gly Ser
                565                 570                 575
Gly Glu Val Leu Leu Pro Ile Ser Ala Pro Gln Asn Tyr Leu Val Phe
            580                 585                 590
Gln Leu Lys Ala Glu Asp Ser Asp Glu Gly His Asn Ser Gln Leu Phe
        595                 600                 605
Tyr Thr Ile Leu Arg Asp Pro Ser Arg Leu Phe Ala Ile Asn Lys Glu
    610                 615                 620
Ser Gly Glu Val Phe Leu Lys Lys Gln Leu Asn Ser Asp His Ser Glu
625                 630                 635                 640
Asp Leu Ser Ile Val Val Ala Val Tyr Asp Leu Gly Arg Pro Ser Leu
                645                 650                 655
Ser Thr Asn Ala Thr Val Lys Phe Ile Leu Thr Asp Ser Phe Pro Ser
            660                 665                 670
Asn Val Glu Val Val Ile Leu Gln Pro Ser Ala Glu Glu Gln His Gln
        675                 680                 685
Ile Asp Met Ser Ile Ile Phe Ile Ala Val Leu Ala Gly Gly Cys Ala
    690                 695                 700
Leu Leu Leu Leu Ala Ile Phe Phe Val Ala Cys Thr Cys Lys Lys Lys
705                 710                 715                 720
Ala Gly Glu Phe Lys Gln Val Pro Glu Gln His Gly Thr Cys Asn Glu
                725                 730                 735
Glu Arg Leu Leu Ser Thr Pro Ser Pro Gln Ser Val Ser Ser Ser Leu
            740                 745                 750
Ser Gln Ser Glu Ser Cys Gln Leu Ser Ile Asn Thr Glu Ser Glu Asn
        755                 760                 765
Cys Ser Val Ser Ser Asn Gln Glu Gln His Gln Gln Thr Gly Ile Lys
    770                 775                 780
His Ser Ile Ser Val Pro Ser Tyr His Thr Ser Gly Trp His Leu Asp
785                 790                 795                 800
Asn Cys Ala Met Ser Ile Ser Gly His Ser His Met Gly His Ile Ser
                805                 810                 815
Thr Lys Val Gln Trp Ala Lys Glu Ile Val Thr Ser Met Thr Val Thr
            820                 825                 830
Leu Ile Leu Val Glu Asn Gln Lys Arg Arg Ala Leu Ser Ser Gln Cys
        835                 840                 845
Arg His Lys Pro Val Leu Asn Thr Gln Met Asn Gln Gln Gly Ser Asp
    850                 855                 860
Met Pro Ile Thr Ile Ser Ala Thr Glu Ser Thr Arg Val Gln Lys Met
865                 870                 875                 880
Gly Thr Ala His Cys Asn Met Lys Arg Ala Ile Asp Cys Leu Thr Leu
                885                 890                 895
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B1

<210> 6
<211> 3657
<212> DNA
<213> Xenopus

<400> 6

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acattgccac actgtttcta ggcatgaaaa aactgcaagt ttcaactttg tttttggtgc     120
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aactttgatt cttcaagatg ctgcttctct tcagagccat tccaatgctg ctgttgggac   180
tgatggtttt acaaacagac tgtgaaattg cccagtacta catagatgaa gaagaacccc   240
ctggcactgt aattgcagtg ttgtcacaac actccatatt taacactaca gatatacctg   300
caaccaattt ccgtctaatg aagcaattta ataattccct tatcggagtc cgtgagagtg   360
atgggcagct gagcatcatg gagaggattg accgggagca aatctgcagg cagtcccttc   420
actgcaacct ggctttggat gtggtcagct tttccaaagg acacttcaag cttctgaacg   480
tgaaagtgga ggtgagagac attaatgacc atagccctca ctttcccagt gaaataatgc   540
atgtggaggt gtctgaaagt tcctctgtgg gcaccaggat tcctttagaa attgcaatag   600
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gcattgatgt gctaaccaga gcagatgggg tgaaatatgc agatttagtc ttaatgagag   720
aactggacag ggaaatccag ccaacataca taatggagct actagcaatg gatgggggtg   780
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gctcgggtga agttctgctt cccatcagcg ctcctcaaaa ctatttagtt ttccagctca  1920
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cattatccac caatgctaca gttaaattca tcctcaccga ctcttttcct tctaacgttg  2160
aagtcgttat tttgcaacca tctgcagaag agcagcacca gatcgatatg tccattatat  2220
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aattgctaca acctttttaat cattaggcat gcaagtgaga atgcacaaag gcaagtgctt  3120
tagcatgaaa gctaaatata tggagtctcc cctttccctc tgatggatgg ggggagacac  3180
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B1

aggacagtgc ataaatatac agctgctttc tatttgcatt tcacttggga atttttttgtt 3240
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ttatatacac gcattttgtg tttgtgtata tatttcaagt ccattcagat atgtgtatat 3600
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<210> 7
<211> 323
<212> PRT
<213> Mouse FRZB-1

<400> 7

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20 25 30
Ala Ala Cys Glu Pro Val Arg Ile Pro Leu Cys Lys Ser Leu Pro Trp
35 40 45
Asn Met Thr Lys Met Pro Asn His Leu His His Ser Thr Gln Ala Asn
50 55 60
Ala Ile Leu Ala Met Glu Gln Phe Glu Gly Leu Leu Gly Thr His Cys
65 70 75 80
Ser Pro Asp Leu Leu Phe Phe Leu Cys Ala Met Tyr Ala Pro Ile Cys
85 90 95
Thr Ile Asp Phe Gln His Glu Pro Ile Lys Pro Cys Lys Ser Val Cys
100 105 110
Glu Arg Ala Arg Gln Gly Cys Glu Pro Ile Leu Ile Lys Tyr Arg His
115 120 125
Ser Trp Pro Glu Ser Leu Ala Cys Asp Glu Leu Pro Val Tyr Asp Arg
130 135 140
Gly Val Cys Ile Ser Pro Glu Ala Ile Val Thr Ala Asp Gly Ala Asp
145 150 155 160
Phe Pro Met Asp Ser Ser Thr Gly His Cys Arg Gly Ala Ser Ser Glu
165 170 175
Arg Cys Lys Cys Lys Pro Val Arg Ala Thr Gln Lys Thr Tyr Phe Arg
180 185 190
Asn Asn Tyr Asn Tyr Val Ile Arg Ala Lys Val Lys Glu Val Lys Met
195 200 205
Lys Cys His Asp Val Thr Ala Val Val Glu Val Lys Glu Ile Leu Lys
210 215 220
Ala Ser Leu Val Asn Ile Pro Arg Asp Thr Val Asn Leu Tyr Thr Thr
225 230 235 240
Ser Gly Cys Leu Cys Pro Pro Leu Thr Val Asn Glu Glu Tyr Val Ile
245 250 255
Met Gly Tyr Glu Asp Glu Glu Arg Ser Arg Leu Leu Leu Val Glu Gly
260 265 270
Ser Ile Ala Glu Lys Trp Lys Asp Arg Leu Gly Lys Lys Val Lys Arg
275 280 285

B1

```
Trp Asp Met Lys Leu Arg His Leu Gly Leu Gly Lys Thr Asp Ala Ser
    290                 295                 300
Asp Ser Thr Gln Asn Gln Lys Ser Gly Arg Asn Ser Asn Pro Arg Pro
305                 310                 315                 320
Ala Arg Ser
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<210> 8
<211> 2176
<212> DNA
<213> Mouse FRZB-1

<400> 8

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